Session 2 – Codes
Welcome and Introductions
Session 2 - Codes

- Unified Development Code (UDC)
- Engineering Design Manual (EDM)
- Fire Code and Local Amendments
- Parkland Dedication for Residential Projects
- MTP / TIA / Rough Proportionality
- Drainage Tiers / Detention Ponds / Water Quality (LID)
- FEMA and local floodplains
- Drainageway Protection Zones (DPZ)
- Standard Specifications for Public Works Construction
UNIFIED DEVELOPMENT CODE (UDC)
City Development Codes Prior to UDC

- Zoning Ordinance
- Subdivision Ordinance
- Development Plat Ordinance
- TIA Ordinance
- Sign Ordinance
- Flood Damage Prevention Ordinance
City Development Codes Prior to UDC

• Subdivision Ordinance
  • 1956 - Original ordinance
  • 1969 – Updates (6 pages total)
  • 1997 - Major update; many new items including mandatory stormwater detention
  • 2018 – Water Quality (LID) required [Sub Ord 3.06]
  • 2019 – Atlas 14 updates for drainage
  • 2020 – updates to LID design depths, addition of TSS and bacteria design requirements, & creation of Drainageway Protection Zones (DPZ's)
City Development Codes Prior to UDC

• Traffic Impact Analysis (TIA) Ordinance
  • 2007 - original ordinance
  • 2019 – updates; turn lane & border street evaluation forms, inclusion of Rough Proportionality

• Development Plat Regulations
  • 2013 - original ordinance

• Flood Damage Prevention Ordinance
  • 2020 – updates added local floodplains, restricted lots less than 1 acre in floodplain, & no “net” fill in the floodplains
2018 - Comprehensive Master Plan

Comments received from community wanted stronger ordinances for mobility, water resources, water quality, & stormwater runoff. Many of these comments were from recent projects that were unpopular with Boerne citizens; Legacy at Cibolo (17 Herff) and Shoreline Park as well as drainage concerns from recent projects.
The City’s Community and Economic Development Coordinator met with developers and engineers in a series of developer forums geared toward hearing the development community’s concerns with not only city processes for economic development, platting, infrastructure construction and building permitting but also ordinance standards for construction and development.
UDC History

• 2019 - UDC Steering Committee
  A group of local developers, architects, engineers were appointed by the mayor to serve as sounding board for updates. Committee also included P&Z and council members.

• 2019 - State legislative passes platting requirements
  During the drafting of the UDC, state legislative passed H.B. 3167 (Shot Clock Bill) which made many state law changes to site plan and subdivision platting approval process. These mandatory state requirements were included within the UDC.
UDC Goals

- Combines Development Ordinances
- Minimize confusion and contradiction between different ordinances
- Align development regulations with the 2018 Comprehensive Plan
- Provide a more comprehensive and efficient development process
- Update zoning districts and locations
UDC Adoption

• Adopted on November 24, 2020 with an effective date of July 2021
• Revised February 2, 2022
• Revised April 11, 2023
Chapter 1 – General Provisions
Chapter 2 – Procedures
Chapter 3 – Zoning
Chapter 4 – Residential Sites
Chapter 5 – Non-Residential Sites
Chapter 6 – Subdivision Design
Chapter 7 – Infrastructure Design
Chapter 8 – Environmental Design
Chapter 9 - Signage
UDC Key Items:

6.2 (B)(1) – lot frontage requirements

• No residential lot shall front on collector/arterial roadways
• Residential lots shall not front on roundabout or traffic circle

6.3 (A) – block sizes
UDC Key Items:

7.2 (E) – external connections
• 30 lots require 2 equal points of vehicular access
• Additional connection per each 50 lots

7.2 (F) – street cross sections

7.5 (A)(2) – minimum access separation
UDC Key Items:

8.1 – Floodplain management
8.2 (A) - Watershed protection (DPZ’s and water supply)
8.2 (B) – Water Quality (LID)
8.2 (C) – Impervious Cover Requirements
8.3 – Tree Preservation
UDC Key Items:

8.9 – Lower Glenrose Aquifer

- Geological Assessment Required
- Sensitive Feature Buffer Zone
- Sealing Sensitive Feature
- Protection during construction
Engineering Design Manual (EDM)

Cheryl Rogers
Engineering Design Manual (EDM)

Chapters include as follow:

1) General Design Requirements
2) Street Design
3) Pavement and Subgrade Design Requirements
4) Traffic Impact Analysis (TIA) Requirements
5) Drainage Design Requirements
6) Erosion Control Requirements
7) Domestic Water Design Requirements
8) Sanitary Sewer Design Requirements
9) Reclaimed Water Design Requirements
10) Gas Main Design Requirements
11) Electric Distribution Design Requirements
12) Low Impact Development (LID) Design Requirements
13) Survey Requirements

The UDC defines the requirement, but the EDM describes the engineering method of how to meet the requirement.
History of Engineering Design Manual

- February 23, 2021 – First adopted by Council
- July 27, 2021 – 1st amendment
- February 22, 2022 – 2nd amendment
- April 26, 2022 – 3rd amendment
- April 11, 2023 – 4th amendment (current)
Major Changes from Subdivision Ordinance to EDM

- Detailed submittal requirements and construction plan contents
- “Tiers” for drainage studies
- Traffic signal, roundabout, and turn lane requirements
- Queueing and throat length
- Pavement design loads updates
- Traffic impact and rough proportionality
- Drainage requirements
- Erosion control *new chapter*
- Looping requirements
International Fire Code (IFC) & Local Amendments
International Fire Code (IFC)

• 2021 Model Code adopted by City Council
• Local Amendments adopted by City Council
• Ordinance No. 2022-24
• Model Codes available through the ICC for purchase
• Local Amendments on City Website under “Fire Marshal”
Life Safety Code
NFPA 101 2021 Edition

• Adopted by City Council
• Available for purchase from the National Fire Prevention Association (NFPA)
Fire Code Changes and Amendments

• **510 Emergency Responder Radio Coverage**
  Addresses building interior radio interference of 2-way emergency responder communication coverage systems and requires the communication coverage system to be monitored by a listed fire alarm control unit.

• **507.5.1.2 Fire Hydrant Location / Authorization**
  Provides details for hydrant locations, allowance for fire flow credit, and establishing access easements for hydrants located on an adjacent property.

• **903.2.14 New Buildings**
  Establishes requirement to install automatic fire sprinkler systems in buildings determined to have a fire flow requirement in excess of 1501 gpm.

• **D102.1 Access and Loading**
  Establishes standards for all-weather drivable surfaces used as fire apparatus access roads.

• **D103.5 Fire Apparatus Access Road Gates**
  Requires plans for a gate constructed across a fire apparatus access road to be approved by the fire code official.
Fire Code Changes and Amendments

• Sec. 503.2.1.1 Divided Entrance to property – 20 feet clear width on approach

• Sec. 503.2.1.2 Mountable Curbs – allowed when approved by the fire code official.

• Sec. 503.2.3 Surface – FAAR must concrete or asphalt.

• Sec. 503.2.8 Angles of approach and departure – 6%

• Sec. 503.3 Marking – Fire lane marking spacing is 20 feet.

• Sec. 503.3.1 Tampering with fire lane markings – Unlawful to tamper in any way.
• **Fire Code Changes and Amendments**

  • Sec. 903.3.1.1.3 Freeze Protection – Adds two additional requirements for freeze protection of fire sprinkler systems.

  • Sec. D103.3 Turning Radius – 50 feet outside and 30 feet inside turning radius.

  • Sec. D103.6.2 Roads more than 26 feet – Requires designation of fire lanes on FAARs less than 34’.

  • Sec. D105.3 Proximity to building – Aerial apparatus access roads required when building over 30’.

      Must be positioned on two sides 15 – 30 feet from buildings.
Significant Changes (NFPA 101)

- **Chapter 9 Two-Way Radio Communication Enhancement Systems.** Minimum requirement added for fire department two-way communication signal strength in all new buildings. Two-way radio communication enhancement systems shall be in accordance with NFPA 1221.

- **Chapter 29 Existing Hotels and Dormitories** New carbon monoxide detection requirement for existing hotels and dormitories. Carbon monoxide alarms or carbon monoxide detectors shall be provided in existing hotels and dormitories where either of the following conditions exists: 1. Guest rooms with communicating garages, 2. Guest rooms containing fuel burning appliances or fireplaces.

- **Chapter 16 New Day Care Extinguishment Requirements.** Provisions making sprinklers mandatory in new daycare occupancies with more than 12 clients. All new day care occupancies shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 9.7. (More than 12 clients)
• Code Processing

• Consultation (Pre-application Meetings)
• Plan Review
• Field Verification
• Recurring Inspection
• Partnering
Marginal Gains
Parkland Dedication (residential projects only)
Parkland Dedication

• Land and Improvements

• Calculated based on existing level of service
  • 41.8 people per park acre
  • $50,000 per acre

• Land Dedication (City Option)
  • Single Family – 1 acre for every 35 units
  • Multi-Family – 1 acre for every 50 units

• Fee in Lieu of Land
  • Single Family – Market Value / 35 units
  • Multi-Family – Market Value / 50 units
Parkland Dedication

- Park Development Costs
  - Existing LOS – $50,000 per acre
  - Single Family – $1,428.57 per unit
  - Multi-Family - $1,000 per unit

- Standards for Land Dedication
  - Floodplain, DPZ, Street Frontage, Access, etc.
Parkland Dedication

• Process
• Pre-Application
• Master Development Plan
• Plat
Major Thoroughfare Plan (MTP)
Traffic Impact Analysis (TIA)
Rough Proportionality
Major Thoroughfare Plan (MTP)

- Current version adopted 4/11/2023
- Planning tool for *IF* a parcel is developed
- City’s initial roadway concept plan was developed in 1974
Major Thoroughfare Plan (MTP)

1974

2004

2010

2023
Major Thoroughfare Plan (MTP)

Context Areas
- Central
- Standard
- Preservation

Legend:
- City Limits
- Extraterritorial Jurisdiction
- Off-Street Multi-Use Trails
  - Trail (Conceptual)
  - Trail (Existing)
  - Trail (Proposed)
- Thoroughfare Plan
  - Arterial (IF Developed)
  - Arterial (Existing)
  - Collector (IF Developed)
  - Collector (Existing)

Note:
The intended use of this Thoroughfare Plan is to provide for future connectivity if development occurs along the dashed roadways and trails and to provide the ultimate function of roadways as arterials or collectors in the City’s transportation network. Final alignments may differ, but the connections are intended to remain between roadway or trail facilities.

Note:
UDC 7.2(F)(3) defines the street cross section standards and right-of-way requirements based on classifications on this map or otherwise required by Code.

The Thoroughfare Master Plan was adopted by City council on 4/11/2021.
Major Thoroughfare Plan (MTP)
Traffic Impact Analysis (TIA)

• Boerne 1st adopted TIA ordinance in 2007, updated in 2019, & defined further with UDC/EDM adoption in 2021.

• Identify traffic impacts associates with a specific development

• Identify mitigation measures that address those impacts

• 2-mile impact area along the travel path

• See Chapter 4 of the Engineering Design Manual (EDM) for current requirements
TIA – When is it required?

• “No masterplan, plat, LOC, zoning change, SUP, building permit application shall be approved unless a Traffic Impact Analysis (TIA) or Peak Hour Trip (PHT) generation form is completed and approved.

• Trip numbers for analysis:
  • 100 trips – TIA required
  • 75 trips – analysis at signalized intersections within TIA
  • 50 trips – analysis at stop intersections within TIA
  • 5 inbound trips – right or left turn lane may be required
TIA – Scoping Meeting

• Establish framework of TIA prior to preparing the TIA (required)

• Discuss following topics:
  • Build out year
  • Phasing
  • Background traffic growth
  • Peak periods for analysis
  • Trip distribution
  • Trip Assignment
  • Intersections for Analysis
### TIA Peak Hour Trip (PHT) Generation Form

The image shows a TIA Peak Hour Trip Generation Form for the City of Boerne, Texas. The form is used to complete worksheets as requirements for Zoning, Master Plan, Infrastructure Documents LOC, and Building Permit submittals. If trips exceed the thresholds provided in the Engineering Design Manual, a Traffic Impact Analysis (TIA) or other traffic documents must be prepared. Prior to preparing a TIA, contact Engineering and Mobility to schedule a TIA Scoping Meeting.

#### Form Details:
- **Project Name:** Example Site
- **Preparer Name:** Engineer Name
- **Preparer Email:** Engineer Email
- **Preparer Phone:** Engineer Phone
- **Type of Application:** Infrastructure Documents LOC

#### Data Table:

<table>
<thead>
<tr>
<th>ITT Code</th>
<th>Land Use</th>
<th>Variable</th>
<th>Density</th>
<th>AM Peak Hour Rate</th>
<th>AM Total Trips</th>
<th>AM In</th>
<th>AM Out</th>
<th>PM Peak Hour Rate</th>
<th>PM Total Trips</th>
<th>PM In</th>
<th>PM Out</th>
<th>Other Peak Hour Rate</th>
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<td>730</td>
<td>General Office Building</td>
<td>1,000 SF</td>
<td>20</td>
<td>1.16</td>
<td>25</td>
<td>20</td>
<td>3</td>
<td>1.15</td>
<td>23</td>
<td>4</td>
<td>29</td>
<td>0.55</td>
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<tr>
<td>520</td>
<td>Fast Casual Restaurant</td>
<td>1,000 SF</td>
<td>5</td>
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<td>7</td>
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<td>71</td>
<td>39</td>
<td>22</td>
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</tr>
</tbody>
</table>

**Total**

|              |             |         |         |                   |                |       |        |                   |                |       |        |                     |             |         |           |

- **Peak Period:** SAT/SUN
- **Peak Hour Trips:** 181
- **1% Required:** YES
- **Tire Load Evaluation Required:** YES

---

**INTEGRITY • COLLABORATION • RESPECT • SERVICE • EXCELLENCE**
Border Street Worksheet
City of Boerne, Texas

Development Frontage? Yes
30' Pavement Width
34' Right-of-way Width
7' ROW Dedication (ft)
4' Pavement Widening (ft)
Reviewed By

Figure 4.5 Border Street Worksheet Example
# TIA Turn Lane Evaluation Worksheet

**Project Name:** Example Project

**Legal Description:** Example Legal Description

**Date:** March 20, 2023

**Preparer Name:** Engineer Name

**Preparer Email:** Engineer Email

**Preparer Phone #:** Engineer Phone

**Type of Application:** Master Plan

**Peak Period:** AM

**Land Use(s):** Single-Family Residential Attached, General Office

**Total PHT:** 96

**Inbound Volume:** 62

Provide depiction of turning movements:

![Diagram of turning movements]

Reviewed By

Worksheet Last Updated: 3/20/2023
**TIA Consistency Worksheet**

**City of Boerne, Texas**

Complete this worksheet as requirements for Zoning, Master Plan, Infrastructure Documents (LOD) and Building Permit submittals. If trips exceed the thresholds provided in the Engineering Design Manual, a Traffic Impact Analysis (TIA) must be prepared. Contact Engineering and Mobility to schedule a TIA Scoping Meeting.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Legal Description</th>
<th>Date of Approval</th>
<th>Title on Previously Approved TIA</th>
<th>Date on Previously Approved TIA</th>
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</thead>
<tbody>
<tr>
<td>[province]Example</td>
<td>[lot, block, street]</td>
<td>[0/26/026]</td>
<td>[TIA for [example project]]</td>
<td>[10/10/019]</td>
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<table>
<thead>
<tr>
<th>Preparer Name</th>
<th>Engineer Name</th>
<th>Engineer Grade</th>
<th>Preparer Phone</th>
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<tr>
<td>John Doe</td>
<td>John Doe</td>
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<th>Land Use</th>
<th>Variable</th>
<th>AM Peak Hour Rate</th>
<th>AM Trips</th>
<th>PM Peak Hour Rate</th>
<th>PM Trips</th>
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</thead>
<tbody>
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<td>[Land Use]</td>
<td>[Variable]</td>
<td>[AM Peak Hour Rate]</td>
<td>[AM Trips]</td>
<td>[PM Peak Hour Rate]</td>
<td>[PM Trips]</td>
</tr>
</tbody>
</table>

**TRIPS ON CITY APPROVED TIA:**

- **Simple Family Detached Housing**: 210
  - 400
  - 0.74
  - 223
  - 83
  - 256
  - 0.09
  - 446
  - 20
  - 185
  - 0.03
  - 419
  - 226
  - 163

**TOTAL ALLOWED TRIPS:**

- 223
- 83
- 256
- 446
- 20
- 185
- 419
- 226
- 163

**EXISTING TRIPS IN DEVELOPMENT:**

- **Simple Family Detached Housing**: 220
  - 400
  - 0.74
  - 220
  - 82
  - 106
  - 0.09
  - 267
  - 198
  - 99
  - 0.03
  - 251
  - 136
  - 116

**TOTAL EXISTING TRIPS:**

- 240
- 82
- 106
- 267
- 198
- 99
- 251
- 136
- 116

**PROPOSED TRIPS IN DEVELOPMENT:**

- **Simple Family Detached Housing**: 220
  - 400
  - 0.74
  - 220
  - 82
  - 106
  - 0.09
  - 267
  - 198
  - 99
  - 0.03
  - 251
  - 136
  - 116

**TOTAL PROPOSED TRIPS:**

- 74
- 82
- 106
- 267
- 198
- 99
- 251
- 136
- 116

**ALLOWED:**

- 223
- 83
- 256
- 446
- 20
- 185
- 419
- 226
- 163

**EXISTING + PROPOSED:**

- 240
- 82
- 106
- 267
- 198
- 99
- 251
- 136
- 116

**TRIPS REMAINING:**

- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0

**Does the existing + proposed trips exceed the allowed trips by 5%?**

- Yes

**Description of Mitigation:**

- [List of mitigation measures]

- Total Mitigated: [Number]

Reviewed/Approved by (City of Boerne): [Signature]

INTEGRITY • COLLABORATION • RESPECT • SERVICE • EXCELLENCE
Rough Proportionality

• US Supreme Court decisions:
  • Nollan vs. California Coastal Commission (1987)
  • Dolan vs. City of Tigard (1994)

• Texas Supreme Court
  • Flower Mound vs. Stafford Estates (2002)

• 2005 – 79th session of Texas legislative (HB 1835)
  • “Developer will bear a portion of the costs of municipal infrastructure improvements in an amount that is roughly proportion to the proposed development.”
Rough Proportionality

- City supplied spreadsheet
- Updated by City when needed for Construction Costs
- Establishes “maximum financial obligation”
- Can be challenged in appeal process
- TIA identifies impacts, mitigation improvements and cost.
Rough Proportionality (RP)

• Develops the project demand on the transportation system:

• Current Examples:
  • 10,000 SF Office = $38,403
  • 2,500 SF QSR = $84,432
  • 200 MF Apartments = $667,193
  • 250 SF Lots = $1,474,376
  • 600 Student M.S. = $2,073,062
RP – Project Supply

• Roads & Improvements to be provided by the applicant
• Spreadsheet determines $ per lane mile
• Design engineer provides estimate for intersection improvements
• City uses KCAD land value for ROW dedication unless detail of actual land cost can be provided.
RP – Determination

• Supply/Demand Comparison

<table>
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<tr>
<th>SUPPLY / DEMAND COMPARISON:</th>
<th>Cost</th>
<th>Comparison</th>
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</thead>
<tbody>
<tr>
<td>TOTAL CAPACITY (SUPPLY) ADDED TO SYSTEM:</td>
<td>$537,000</td>
<td>SUPPLY &gt; DEMAND</td>
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<tr>
<td>TOTAL DEMAND PLACED ON THOROUGHFARE SYSTEM:</td>
<td>$461,753</td>
<td>85.99%</td>
</tr>
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</table>

Based upon the results of this rough proportionality analysis, the capacity (supply) provided by the proposed development exceeds the anticipated demand it places on the system. Given these assumptions, only 85.99% of the capacity supplied can be attributed to the proposed development. Therefore, the roadway improvements are NOT roughly proportional to the demands placed on the system (i.e., the applicant is adding more capacity than needed to support their development).

• For this example, project the required improvements exceed the demand created by the project. City will determine which code required improvement to be removed or reduced.
Drainage Tiers
Detention Ponds
Low Impact Development (LID)
## Drainage Tiers

**Tier 1 (Exhibit/Resident Letter)**
1. Adding area of impervious cover less than 100 square feet; or
2. Adding less than 4% of the gross lot size of impervious cover; or
3. Meets one of the criteria below:
   a. Single family residential: Two or less lots
   b. Multi-family residential: Two or less lots with 2 or less units on each lot

**Tier 2 (Drainage Study)**
1. Meets one of the criteria below:
   a. Single family residential: Four or less lots
   b. Multi-family residential: Four or less lots with 2 or less units on each lot
   c. All other categories:
      i. Single lot with total increase in impervious cover less than 5,000 SF

**Tier 3 (Drainage Study and Downstream Drainage Assessment)**
2. Development does not meet requirements of Tier 1 or 2
**NO ADVERSE IMPACT LETTER**

**SITE EXHIBIT WITH EXISTING AND PROPOSED DRAINAGE FLOW LINES MUST BE ATTACHED**

Property Address: ________________________________

Date Submitted: ________________________________

Contact Information:

Property Owner
Name: _______________________________________
Telephone #: _________________________________
Email: _______________________________________

Project Description

_____________________________________________________________________________________

_____________________________________________________________________________________

Construction of this project will not alter the existing drainage patterns and will not adversely affect any of the adjacent neighbors or downstream properties.

I acknowledge that Section 11.086 of the Texas Water Code states that no person may divert or impound the natural flow of surface waters in a manner that damages the property of another and that I may be held responsible if a person's property is injured by an overflow of water resulting from this project.
Rational Method

- No increase allowed in flow rate, velocity, or depth for all design storms
- Watershed of 25 acres or less
- No upstream detention/timing considerations required
- Existing, proposed, and ultimate conditions
- Runoff coefficients (Zoning District vs. Composite Analysis)
- Must use maximum impervious cover permitted by zoning for proposed condition
- Sheet flow – max 100 feet
- Adjustment factors

<table>
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<th>Storm Frequency</th>
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<td>4% (25-year)</td>
<td>1.1</td>
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<tr>
<td>2% (50-year)</td>
<td>1.2</td>
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<tr>
<td>1% (100-year)</td>
<td>1.25</td>
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Computer Models

- HEC-HMS
- Use SARA Floodplain models as baseline (on SARA D2MR site)
- NEH-630 used for runoff calculations (SCS)
- Snyder-Clark Synthetic Unit Hydrograph (or City Engineer approved equivalent)
Hydraulics

- Open Channels
  - Manning’s Equation: watersheds smaller than 25 acres
  - HEC-RAS: watersheds greater than 25 acres, or normal depth greater than 3 feet

- Closed Systems
  - TxDOT Hydraulic Manual
  - Culvert
    - 1’ freeboard for 100-year storm
    - Provide calculations for headwater, tailwater, flowline, etc.
    - Provide design lengths for culvert railing
Hydraulics

• Closed Systems (Continued)
  • Storm Drains
    • No surcharge – 5-year storm
    • EGL/HGL
    • Max velocity – 12 fps for 5-year storm
    • Min velocity – 3 fps for 5-year storm
    • Maximum vertical inlet opening is 6 inches
    • Curb inlets or sidewalk underdrains (grate inlets and slot inlets must be approved by City Engineer)
  • Storm drain outfall
    • Adequate outfall
    • Max exit velocity is 5 fps
    • Provide energy dissipation calculations
Detention Ponds

- Detention is mandatory
  - Chapter 2 lists requirements for requesting exemption for detention
- Calculate total volume – size pond
- Provide 20% extra volume for silt
- Outfalls must be designed as a culvert
- 1’ freeboard
- 4’ top for earthen embankment
- 1% slope in detention pond bottom, or 0.5% with pilot channel
- Maintenance ramp
- Parking lot detention
- Pumped detention ponds
- Retention ponds
Streets

• Outfalls at streets
  • “Streets may not be used as a continuation of or discharge for other drainage facilities”
  • City Manager Exception – allows for outfall to street if requirements are met
    • Flow in direction of gutter
    • 3” depth or less
    • Max velocity 5 fps

• Street Stormwater Carrying Capacity
  • Dry lanes
  • Curb full
  • Contained within ROW
  • Thoroughfares shall now allow storm drainage to cross traffic lanes

• Border Street Policy – streets must meet these requirements
Channels

- Freeboard – typically 0.5’
- 15’ access next to channel
- Provide access every 1,000’ along channel
- Channel lining
Grading Plans

- Interceptor channels
  - Where 2+ lots drain to each other
  - Where more than 2 acres of offsite water drains to proposed development

- Provide lot grading types
- “C” residential lots only permitted when adjacent to open spaces or parks
- Maximum 5’ cut or fill
- Interbasin Diversion
  - May only divert 20% of the watershed or less than 1 acre, whichever is smaller
Low Impact Development

- Calculate rainfall depths
  - 1.35” – redevelopment
  - 1.66” – new impervious cover
  - 2.35” – upstream from Boerne Lake
- Remove 80% TSS and 60% bacteria (exceeds TCEQ)
- Online vs. offline facilities
- Freeboard
- Maintenance access ramps
- Overtreatment of 10% of site allowed
- Infiltration for a reduction in volume required
FEMA & Local Floodplains

Jeff Carroll
Flash Flood Alley

- Large metropolitan area is one of the most flood-prone regions in North America.

- This is due to several factors, including geography, climate, and urbanization. Our landscape's proximity to the Balcones Escarpment, a geologic fault zone extending in an arc across Texas, means that warm weather masses moving in from the coast are trapped, producing heavy rainfall events. Steep terrain, shallow soils, and narrow river channels combine to send this runoff quickly downhill.

- The result is deep, fast, and erosive floodwaters that can potentially affect communities downstream, threatening lives and property throughout the basin.
Boerne Flood of Record (per FEMA)

- Overnight September 26-27, 1964
- 17 inches in upper reaches of watershed (only 4.47” in Boerne)
- 2% annual chance (50-year) event; 36,400 cubic feet/second (cfs) at the USGS gauge station.
SCS Flood Control Projects

January 1972 - The Texas Water Commission granted permission to the City of Boerne to construct and maintain a dam and reservoir on Cibolo Creek for municipal purposes to aid in flood control.

November 1979 - The Certificate of Adjudication was amended, when the city asked to have the right to utilize the water from the reservoir for domestic purposes.

September 2005 - Boerne City Council approved development of City Lake Park
Boerne Watershed

- Approximate 21,800 acres upstream of the 4 upstream SCS structures
- Approximate 32,000 acres upstream of the River Road park
- Boerne City Limits is approximate 7,600 acres
Boerne Rainfall events – post flood control

- June 1997 18” in 30 hours upper watershed
  8.15” in Boerne
- March 1998 3.09” in 24 hours
- October 2000 5.35” in 24 hours
- August 2001 6.89” in 24 hours
- July 2002 30.9” over 6 days
- August 2007 7.61” in 19 hours
- May 2015 9.05” in 24 hours
- July 2002 30.9” over 6 days
- August 2007 7.61” in 19 hours
- September 2018 Rained almost every day of the month with total of 16.68”

20.10” for the entire month
32,200 CFS at gauge station

100-year (Atlas 14) 24-hour event = ____?

Rainfall data provided by John Kight, 2002 HDR study & FEMA FIS
FEMA Floodplains

• First Boerne area Flood Insurance Rate Maps (FIRM) maps created in 1976. Maps have been revised many times since. Current FEMA maps are 2010 for most of town.

• All of town is within a FEMA flood zone; Zone AE, A or X. The majority is “Zone X” which is defined as “depth less than 1 foot OR drainage areas less than 1 square mile (640 acres)”

• Floodplain requirements were formerly within the “Flood Damage Prevention Ordinance”, now included in Section 8.1 of the UDC.

• State vesting code specifically excludes vesting for federal floodplain items (TAC 245.004).
FEMA Floodplains – SARA updates

• San Antonio River Authority (SARA) is currently in process of updated maps for entire San Antonio River basin (includes all the city).

• SARA models incorporate the higher NOAA “Atlas 14” rainfall values as well as modeling improvements.

• SARA models have been submitted to FEMA and starting 1/1/2023 the City floodplain administrator has adopted the San Antonio River Authority (SARA) models as our “best available information” for the floodplain limits.

• Watch for notices on upcoming FEMA hosted public meetings to discuss the map changes.

Don’t drown in doubt! Preview the new Draft Floodplain Maps
https://sariverauthority.org/safe
FEMA Floodplains

• City regulates to the 1% Annual Chance Floodplain commonly referred to as the 100-year floodplain

• City has no current rules for the 0.2% Annual Chance Floodplain (500-year), but some critical uses (hospitals, etc.) do refer to this higher standard

• Floodway has more stringent requirements above the floodplain (zone A/AE)
Boerne Local Floodplains

Adopted August 2020 with updates to Flood Damage Prevention Ordinance. Then included within UDC section 8.1(D)(5):

• Watershed of greater than 25 acres AND a minimum flow depth of 1-foot.

• Same rules as FEMA floodplains

• See City Feature Layer Map for approximate locations of local floodplains

• Local floodplain map available within the EDM or on the City’s interactive map viewer
Boerne Floodplain general requirements

Current requirements for subdivision and development plats within UDC section 8.1(D)(1):

- All public water/sewer shall be designed to City of Boerne standard to minimize infiltration of floodwaters into the system.

- Building Slab elevation shall be 1 foot above the Base Flood Elevation (BFE) if flood model uses Atlas 14 rainfall depths, otherwise 2 foot above.

- Filling or disposing of any material which will diminish the water flow volume must be compensated by remedial action. An equal amount of storage volume must be created.
Boerne Subdivision Floodplain requirements

Current requirements for subdivision and development plats within UDC section 8.1(D)(3):

• BFE’s required for all local and FEMA floodplains. If FEMA floodplain and more than 4 lots or greater than 2 acres requires submittal to FEMA.

• No new “island” subdivision.

• Unflooded access to an arterial street, OR ¼ mile, whichever is less, during a 25% flood event.
Boerne Residential Floodplain requirements

Adopted August 2020 with updates to Flood Damage Prevention Ordinance. Then included within UDC section 8.1(D)(3):

• Lots less than 1.0 acre – no portion of proposed residential lot shall have floodplain

• Lots 1.0 acre or greater – floodplain allowed on lot, but habitable structure must be outside the floodplain
Boerne Floodway requirements

Current requirements for subdivision and development plats within UDC section 8.1(D)(6):

• All encroachments (fill, new construction, substantial improvements, & other development) prohibited except for those activities allowed in Drainageway Protection Zones.

• Existing structures and uses shall not be expanded or enlarged.
Drainageway Protection Zones (DPZ’s)
Drainageway Protection Zones (DPZ’s)

- Adopted February 2020 with updates to the Subdivision Ordinance. Then included within UDC section 8.2
- DPZ’s are a **water quality** feature to protect, and for the **restoration**, of vegetation along the riparian zones.
- Specific rules for improvements within Zone 1 (inner) and Zone 2 (outer).
- Width of DPZ is based upon the watershed acreage, see as follows for width per each side:

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<th>Acreage</th>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Total</th>
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<tr>
<td>25-128</td>
<td>35’</td>
<td>20’</td>
<td>55’</td>
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<tr>
<td>128-320</td>
<td>55’</td>
<td>30’</td>
<td>85’</td>
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<tr>
<td>320-640</td>
<td>70’</td>
<td>50’</td>
<td>120’</td>
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<tr>
<td>&gt;640</td>
<td>100’</td>
<td>50’</td>
<td>150’</td>
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DPZ map available within the EDM or on the City’s interactive [map viewer](#)
DPZ Restrictions

• Shall remain free of construction unless otherwise indicated [UDC 8.1(A)(2)]

• Neighborhood local streets are not allowed to cross

• Perpendicular local street may be allowed by CMO for extenuating circumstances

• Perpendicular arterial/collectors as shown on MTP are allowed

• Private driveways are allowed by Engineering & Mobility Director for extenuating circumstances
DPZ Exceptions

• Zone 1 may allow the following:
  • Allowed perpendicular crossings (trails, utilities, streets)
  • Fences that do not obstruct flow
  • Trails for Public and private parks or open spaces
  • Trails along the Parks Master Plan

• Zone 2 may allow the following:
  • Allowed street crossing and utilities
  • Fences that do not obstruct flow
  • Trails for Public and private parks or open spaces
  • Trails along the Parks Master Plan
  • Water Quality or flood control systems with minimum disruption to the natural vegetation
Standard Specifications for Public Works Construction

- Defines materials, execution, & field quality control for public infrastructure.

- Includes Standard details for construction.

- State vesting code specifically excludes regulations for utility connections & construction standards for public works (TAC 245.004).

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Common Boerne Material Issues:

- Concrete – plant mix 4,000 psi required for all structural concrete
- Earthwork – Modified Proctor Method (D1557) density testing method
- Streets - Embankment under roadways less than 20 plasticity index (PI)
- Utility Pipes - Tracer Wire
- Sewer - Pipe shall be SDR 35, unless greater than 14’ depth
- Revegetation - 85% of disturbed areas must have vegetation established prior to acceptance
- Sewer - All sanitary sewer manholes require chimney seals and interior/exterior coatings
- Sewer – “dog-house” manholes for connections to existing mains are not allowed
Questions